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Development of a Probability Discounting Task of Communication for Adults Who Stutter

Luis R. Rodriguez[1], Erin B. Rasmussen[1], and Daniel Hudock[2]
[1] Department of Psychology, Idaho State University
[2] Department of Communication Sciences and Disorders, Idaho State University

Previous research indicates speaking may be emotionally and socially risky for adults who stutter (AWS) due to psychological distress induced by others following a dysfluency. This may impact communication-related decision-making; however, no measure had been developed to objectively quantify this variable. The present study aimed to develop and validate the Probability Discounting for Communication (PDC) task, a behavioral measure of risk taking that characterizes decreasing subjective value of hypothetical communication engagement as the probability of stuttering and listener reaction change. AWS ($n = 67$) and adults who do not stutter (AWNS; $n = 93$) were recruited from an online listserv and MTurk. Across a series of trials, participants completed the PDC by using a visual analog scale to indicate their subjective value of communication as probabilities of stuttering (1%–99%) and magnitudes of negative listener reaction risk (10%, 50%, 90%) were manipulated. They also completed measures of stuttering, communication, and demographics. Results revealed communication was discounted hyperbolically across increasing dysfluency odds. AWS showed more systematic discounting patterns compared to AWNS suggesting AWS may be more sensitive to communication due to experiences with stuttering. A magnitude effect was found with both AWS and AWNS discounting communication more steeply with increasing negative listener reaction risk. Significant associations were observed between discounting, stuttering, and communication measures among AWS, which indicates that sensitivity to risk in the context of stuttering and social reaction may influence communication engagement. Overall, the PDC functions as a measure to assess underlying decision-making patterns related to communication among AWS, which may inform treatment.

Keywords: communication, probability discounting, risk taking, speech fluency, stuttering

Childhood-onset fluency disorder (i.e., stuttering) is a neurodevelopmental disorder characterized by a high frequency of atypical disruptions in speech fluency. Disruptions can appear in the form of repetitions (e.g., I-I-I-I; k-k-k-k-k), prolongations (e.g., aaaapple), and blocks (e.g., b_ _ _ _lock). Stuttering typically begins around 3 years of age and may persist into or spontaneously reappear in adulthood. In addition to speech disruptions, secondary physical behaviors can also co-occur (e.g., eye blinks, head jerks, tremors, sound, syllable avoidances, etc.; American Psychiatric Association, 2013; Bloodstein & Ratner, 2008; Guitar, 2014; Lewis, 1997; Packman & Attanasio, 2017; Sheehan, 1970).

Adults who stutter (AWS) report a lower quality of life relative to adults who do not stutter (AWNS) due to experiences with external- and self-stigma, and frustration (Beilby et al., 2012, 2013; Boyle, 2017; Boyle et al., 2018; Bricker-Katz et al., 2010, 2013; Butler, 2013; Corcoran & Stewart, 1998; A. Craig et al., 2009; McAllister et al., 2013; Plexico et al., 2009, 2019). Further, lower quality of life among AWS may also be attributed to a pattern of ongoing worries about upcoming communicative experiences, which is similar to core symptoms of anxiety-related disorders.

Notably, trait anxiety, social anxiety, and other anxiety-related disorders have been documented to appear more frequently in AWS compared to AWNS (Gunn et al., 2014; Iverach et al., 2018; Menzies et al., 2008; Messenger et al., 2004) with moderate to large effects ($g = 0.57–0.8$; A. Craig & Tran, 2014). The occurrence of a comorbid anxiety disorder with stuttering creates greater psychological impact upon the individual, which can negatively impact speech gains made in stuttering treatment (A. R. Craig & Hancock, 1995; Hancock & Craig, 1998; Iverach et al., 2018). Among a clinical sample of AWS, those diagnosed with social anxiety disorder were more likely to report increased emotional and behavioral difficulties (e.g., higher depression symptoms) and increased avoidance of speaking situations relative to those who did not have a social

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Luis R. Rodriguez https://orcid.org/0000-0001-6025-1264
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Correspondence concerning this article should be addressed to Erin B. Rasmussen, Department of Psychology, Idaho State University, 921 S.8th Avenue, Stop 8021, Pocatello, ID 83209, United States. Email: erinrasmussen@isu.edu

anxiety disorder diagnosis (Iverach et al., 2018). Indeed, this literature demonstrates how a history of aversive experiences and anticipation of future aversive experiences related to one's stuttering may lead to potentially problematic coping (e.g., social avoidance).

Emotional and physical withdrawal from social interactions and attempts to avoid other individuals may prevent aversive communicative experiences and dysfluencies in the short term, but may limit one's long-term choices in valued, important life domains. These domains may include occupation, physical health, sense of self-acceptance, identity, and development and maintenance of intimate relationships in the long-term (Beilby et al., 2012; Boyle & Fearon, 2018; Bricker-Katz et al., 2013; Butler, 2013; Corcoran & Stewart, 1998; Klein & Hood, 2004; Plexico et al., 2019).

Stuttering and Sensitivity to Risk

Although studies describe aversive communicative experiences of AWS across the lifetime (Boyle et al., 2018; Bricker-Katz et al., 2010; Butler, 2013; Corcoran & Stewart, 1998; Plexico et al., 2009), to our knowledge no studies have examined the decision-making processes that may be involved in avoidant communication strategies. Indeed, the probabilistic nature surrounding dysfluency occurrence (e.g., Helgadottir et al., 2014; Packman, 2012; A. Smith & Weber, 2017) and a history of negative communicative experiences (e.g., bullying, mocking, or laughter) may heighten sensitivity to risk within social interactions among AWS. Notably, it has been documented that AWS who perceive themselves as being observed are more likely to experience dysfluencies during a speech task than when they perceive themselves as alone (Alm, 2014; Jackson et al., 2021). The occurrence of this "talk-alone effect" lends further support that changes within the social environment can impact the risk of dysfluency occurrence, which can therefore impact one's decision of when and how to communicate with another individual. For AWS, the choice to engage in communication with another individual increases the likelihood of a stuttering event and possible negative social reaction, whereas the choice to not engage in communication can prevent both. However, a repeated choice of not communicating can also prevent access to reinforcers that functional communication allows them to receive (e.g., social interaction, developing intimate relationships, and employment), which can have long-term physical and mental health consequences (Boyle & Fearon, 2018; Plexico et al., 2019).

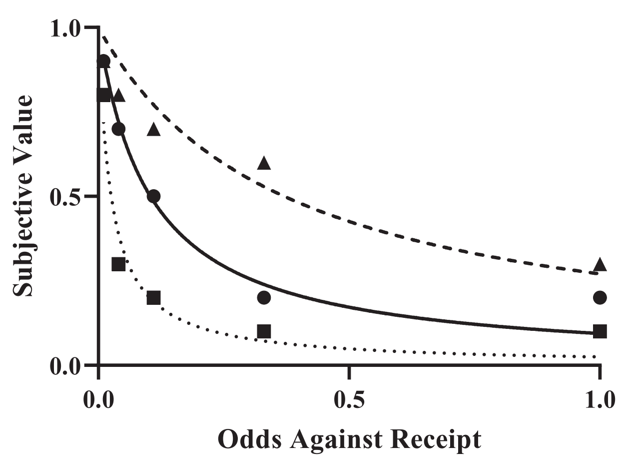
Given the social risks in speech that AWS experiences, it is critically important to understand the social conditions involved in making choices to speak. Currently, however, there is no objective measure that allows for the quantification of sensitivity to risk as a function of dysfluency or a negative social encounter, which makes it difficult to determine the extent to which these factors are important processes in communicative engagement among AWS. The development and validation of such a measure would be an important first step in conducting research in this area. One area in decision-making that may be useful for this kind of measurement is probability discounting.

Probability Discounting

Probability discounting (PD), a behavioral measure of risk taking, refers to a decrease in the subjective value of an outcome as the odds against the receipt of the outcome increase (Green & Myerson, 2010; Rachlin et al., 1991). In other words, the amount someone values a particular outcome will be influenced by the probability of receiving that outcome, and that rate of valuation will differ across individuals. A typical PD task used frequently in the human literature is the adjusting amount procedure (Madden & Johnson, 2010), which involves the systematic manipulation of the smaller, certain amount over varying probabilities. For example, if an individual were to select the larger, uncertain outcome ($10 with a 90% chance) from the choices "$1 for sure versus $10 with a 90% chance of receipt," the smaller, certain amount would be increased systematically on subsequent choice questions (i.e., "$2 for sure versus $10 with a 90% chance of receipt," "$3 for sure vs. $10 with a 90% chance," etc.) until a *preference reversal* for the smaller, certain outcome occurs. This point is used to calculate the "indifference point"—the current subjective value of the larger, uncertain outcome. An indifference point would be calculated as the median of the smaller, certain values of the current and previous trials. For example, if the preference reversal occurred between "$6 for sure versus $10 with a 90% chance" and "$7 for sure versus $10 with a 90% chance," $6.50 would be the indifference point. For this individual, "$6.50 for certain" is subjectively equal to "$10 with a 90% chance of receipt," meaning that if this option is repeatedly presented, 50% of the selection would be for the smaller, certain amount and 50% would be for the larger, uncertain amount.

Indifference points are determined across a wide range of amounts and probabilities. Then, indifference points are plotted against the odds of receiving the outcome. The pattern is predictably hyperbolic (see Figure 1); that is, individuals demonstrate a relatively steep decline in the subjective value of the larger monetary amount at lower odds against receipt and then this value asymptotes at higher odds. This pattern can be described using a hyperbolic equation

Figure 1
Example of Probability Discounting



Note. Example of probability discounting. Here, the subjective value, or indifference point, of a commodity like money decays in a hyperbolic manner as odds against receipt increase. The free parameter *h* from the hyperbolic equation (Mazur, 1987) describes the slope of the line with the triangles (dashed line) representing a relatively less risk-averse individual compared to the squares (dotted line), which would be considered more risk averse. The circles represent someone in the middle.

(Mazur, 1987):

$$V = A/1 + h\theta \quad (1)$$

where V is equal to the subjective value (i.e., indifference point), A is the larger, uncertain amount, Θ is the odds against receipt, $(1/p)-1$, $p =$ probability of receiving, and h is a free parameter that indexes one's rate of discounting. Higher h values indicate a greater preference for the smaller, certain outcome or higher sensitivity to probabilities (i.e., "risk aversion"; steeper decline), whereas lower h values indicate less sensitivity to probabilities and a greater preference for the larger, uncertain outcome (i.e., "risk-taking" behavior; shallower decline).

An alternative to the hyperbolic model is the hyperboloid model of discounting, which includes an additional parameter that raises the denominator to a specified power (Green et al., 1994; Myerson & Green, 1995):

$$V = A/(1 + h\theta)^s. \quad (2)$$

In the hyperboloid function, s refers to a nonlinear scaling parameter that is proposed to characterize sensitivity to the differences between odds. The inclusion of s alters the shape of the hyperbola leading to a leveling off of values at higher odds. An s value of 1 indicates that differences between odds are perceived similarly; however, an individual's subjective values may show little sensitivity across higher odds against reward receipt ($s < 1.0$) compared to lower odds, or vice versa ($s > 1.0$; see Green et al., 1994 for a more detailed analysis on the interpretation of this variable).

An alternative analytic approach to using the h and s free parameters to characterize PD is the area under the curve (AUC; Myerson et al., 2001). To calculate AUC, the area beneath the discounting curve is determined by creating trapezoids formed by the area between each successive subjective value and the corresponding odds (Figure 2). The following equation is used to calculate the area of each trapezoid:

$$AUC = \Sigma(x_2 - x_1)[(y_2 + y_1)/2] \quad (3)$$

where x refers to the successive odds and y refers to the corresponding subjective values. The discounting rate is the sum of the trapezoid areas and is bound between 0 (steepest discounting possible) and 1.0 (no discounting).

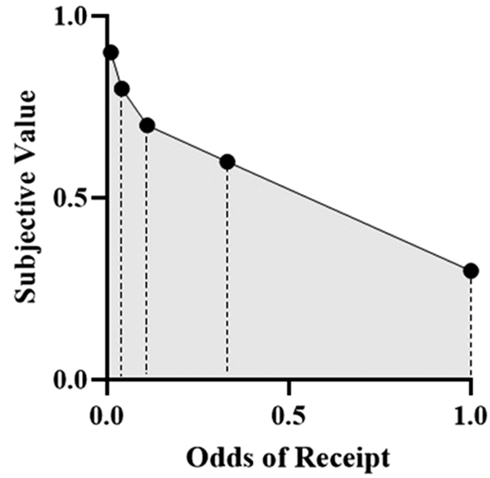
AUC offers an atheoretical analysis but can offset some of the limitations associated with the hyperbolic and hyperboloid equations (i.e., positive skewness, nonhyperbolic patterns) that create difficulties for parametric analysis. This method is not bound by a specific theory (i.e., hyperbolic pattern of discounting), and values tend to be normally distributed and more readily lend themselves to parametric analyses. Further, due to its atheoretical nature, an additional benefit of AUC is it allows for the comparison of discounting values across differing discounting studies (Myerson et al., 2001). Researchers using both h and AUC have shown a related, inverse relation between the values (Myerson et al., 2011).

Probability Discounting and Communication

PD has been used to understand decision-making for money (Madden et al., 2009; Myerson et al., 2011), food, (Rasmussen et al., 2010), sexual health (Berry et al., 2019; Johnson et al., 2015), and medication adherence (Bruce, Bruce, et al., 2018; Bruce et al., 2016). Moreover, PD has the potential for treatment guidance in decisions in which risk is a factor (Bruce, Jarmolowicz, et al., 2018), indicating its usefulness in terms of quantifying patterns of choice using commodities other than money in clinical populations. The choice to speak, and its risks, in AWS may be one such area.

Figure 2

Example of Area Under the Curve



Note. Example of the calculation of area under the curve (AUC) using the equation described in Myerson et al. (2001). The shaded area represents the total area calculated, whereas the dashed lines represent the boundaries of each individual trapezoid. Higher AUC values indicate less discounting (i.e., less risk aversion) and lower AUC values indicate greater discounting (i.e., greater risk aversion).

Each time an AWS chooses to speak, there are at least two probabilities in place: (a) a probability of a dysfluent episode and (b) a risk of a socially aversive event that follows the dysfluency. However, there was not a PD measure that directly examined decision-making around communication or how it was altered by these two events. The purpose of the present study, then, was to develop and validate a PD task that could be used in the stuttering population. Specifically, we determined the extent to which choices about communication made by AWS could be characterized using a PD task. In this task, the subjective value of communication was manipulated as a function of dysfluency probability and the probability of a negative listener reaction to the dysfluency. Further, to help assess the validity of the discounting task, discounting values and the amount of systematic responding (i.e., the extent to which the hyperbolic discounting function accounts for the change in the subjective value of communication) was compared between AWS and AWNS to determine the extent to which group membership differed on this variable. In addition, we examined the extent to which previously established measures of communication participation and stuttering symptoms were related to the PD task.

The study hypotheses were:

1. AWS would demonstrate orderly (hyperbolic fit) and steeper discounting patterns for communication compared to AWNS.
2. Among AWS, a PD task of communication would show significant, negative associations with a measure of

communicative participation. There would be no significant association among AWNS.

3. A PD task of communication would show significant, positive associations with established self-report measures of stuttering severity among AWS. There would be no significant associations among AWNS.

Method

The following measures and procedures were reviewed and approved by the Idaho State University Humans Subjects Committee.

Participants

The researchers recruited adult participants from an online listserv through the National Stuttering Association (NSA), social media, Amazon's Mechanical Turk (MTurk), and by contacting regional speech-language pathologists. To be included in the study, individuals needed to (a) be at least 18 years old, (b) have access to a reliable internet connection, and (c) be proficient in reading and speaking English. Participants were excluded from participation if they self-reported a past or current diagnosis of a speech/language or communication disorder other than stuttering (e.g., alalia, aphasia, apraxia, cleft lip or cleft palate, developmental verbal dyspraxia, dysarthria, etc.) or a past or current diagnosis associated with difficulties in communication (i.e., autism spectrum disorder, dementia, hearing loss, intellectual disability, social pragmatic communication disorder, stroke, or traumatic brain injury). Eligible participants who completed the study were placed into a drawing for one of ten $25 Amazon Gift Cards.

Prior discounting literature has noted medium to large effect sizes (e.g., Bruce et al., 2016; MacKillop et al., 2011). A priori power analysis conducted using G*Power and estimations from J. Cohen (1992) with a medium effect size ($d = 0.5$) indicated approximately 128 participants (64 per group) were required for adequate power. We enrolled 32 additional participants (16 per group) to pilot the online procedure who were included in the final analyses. Therefore, a total N of 160 participants were required to pilot the procedure and complete the study.

Materials

Probability Discounting of Communication (PDC)

The PDC was a novel task that could be administered via pencil and paper or adapted for computer (for this study, it was presented via computer). Participants were asked to recall their most severe moment of stuttering and rate it on various dimensions (e.g., age as it occurred, duration of time dysfluency lasted, people present and their relation to the individual, reaction of others; see Appendix for full measure). Then they were asked to imagine themselves in a speaking scenario with another individual where they will experience their most severe moment of stuttering during the conversation and that the individual with whom they are conversing will have a negative reaction (e.g., laugh/make fun, cut you off, look uncomfortable or frustrated). Across 21 trials, participants used a visual analog scale to select their likelihood of participating in the conversation on a scale of 0 (*I definitely will NOT participate in the conversation*) to 100 (*I definitely will participate in the conversation*) across seven ascending probabilities of occurrence of a severe moment of stuttering (e.g., "During the interaction, there is a *90% chance you will* experience a severe moment of stuttering"): 1%, 10%, 25%, 50%, 75%, 90%, and 99%. In addition, as a measure of the magnitude of severity, three probabilities of a negative reaction (NR) from the listener were presented in ascending order (10% NR, 50%NR, and 90%NR; e.g., "There is a 10% chance the person will respond negatively"). In other words, across the 21 items, each of the probabilities for an occurrence of a negative reaction were held constant while the probability of experiencing a dysfluency was manipulated. The responses on the visual analog scales of the PDC represented the individual's indifference points.

Communication Measures

Participation in communication and speech usage were assessed using the Communicative Participant Item Bank (CPI; $\alpha = .94$; C. R. Baylor et al., 2009; C. Baylor et al., 2013), and the Level of Speech Use Rating Scale (LSURS; C. Baylor et al., 2008). The CPI is a 10-item self-report measure that assesses the extent to which an individual's life situation or experience with a communication disorder affects his or her ability to participate in differing speaking situations with higher scores indicating more communication engagement and fewer difficulties. The LSURS is a single-item self-report measure in which the participant rates their perception of speech demands over the past year. Higher scores on the LSURS indicate greater speech use.

Stuttering Measures

The Overall Assessment of the Speaker's Experience of Stuttering-Adult (OASES-A; $\alpha = .98$; Yaruss & Quesal, 2006, 2010) is a 100-item self-report measure that assesses the overall impact stuttering has on the individual's life from the perspective of the speaker across four domains: participant perceptions of their fluency, overt and covert reactions to their stutter, functional communication difficulties experienced across different environments, and how the stutter has affected their quality of life. Scores are totaled into an overall impact rating and compared to specific cut-offs with higher scores indicating higher negative impact of stuttering. The Subjective Stuttering Scales (SSS; $\alpha = .97$; J. Riley et al., 2004) is an 8-item self-report measure that assesses the extent to which dysfluencies negatively impact functioning over the past week with higher scores indicating a greater impact.

Substance Use and Demographic Variables

Alcohol, nicotine, and illicit substance use can influence rates of discounting (see review MacKillop et al., 2011). Therefore, to control for these factors, participants completed the Alcohol Use Disorders Identification Test—Version C ($\alpha = .62$; Bush et al., 1998), the Drug Abuse Screening Test ($\alpha = .73$; DAST-10; Skinner, 1982), the Penn State Cigarette Dependence Index ($\alpha = .64$; PSCDI), and the Penn State Electronic Cigarette Dependence Index ($\alpha = .37$; PSECDI; Foulds et al., 2015).

The demographics questionnaire asked participants about basic demographic variables (e.g., age, gender, SES, etc.), stuttering history, and past and current experience with stuttering treatment.

Procedure

Participants completed the study online through the survey software Qualtrics®. Upon clicking the link, they were directed to read a welcome script, which then directed them to informed consent. After reading and agreeing to the informed consent, participants completed a brief screener survey to determine if they met inclusion or exclusion criteria. Participants who self-reported meeting the inclusion criteria and none of the exclusion criteria were eligible to continue with the study. Individuals who did not meet the inclusion criteria or endorsed one or more of the exclusion criteria were dismissed from the study.

AWS Group

Enrollment in the AWS group was determined via responses during the screening survey. Individuals who met inclusion/exclusion criteria, self-reported a diagnosis of stuttering, and reported current stuttering were placed into the AWS group. Participants completed the PDC, CPI, OASES-A, SSS, LSURS, and demographic information in a randomized order. The OASES-A was only administered to those in the stuttering group as it is standardized for a stuttering population only. Individuals who endorsed alcohol, nicotine, or illicit substance use within the past year also completed substance use measures. Upon completion of the assigned measures, participants were enrolled in a drawing for one of 10 $25 Amazon Gift Cards.

AWNS Group

Individuals who met the inclusion criteria and denied a past or present stuttering diagnosis were placed into the AWNS group. Participants completed the PDC, CPI, SSS, LSURS, substance use measures, and demographic information in a randomized order. Upon completion of the assigned measures, participants were enrolled in a drawing for one of 10 $25 Amazon gift cards.

Data Analysis

The data were analyzed using IBM SPSS v26 and GraphPad Prism v9. To calculate rate of PD, participants' indifference points were determined for the following probabilities: 1%, 10%, 25%, 50%, 75%, 90%, and 99%. Then, each set of indifference points for each participant was plotted as a function of odds of stuttering ($p/1-p$; $p =$ probability of stuttering) and analyzed using the three discounting equations: area under the curve (AUC), the hyperbolic equation, and the hyperboloid equation. As engagement in communication had not been utilized in prior research, AUC was selected as the optimal way to examine differences between AWS and AWNS groups due to its atheoretical nature and its ability to readily lend itself to parametric statistics as h values are often significantly positively skewed (Myerson et al., 2001). In addition, the significant interaction between h and s values makes it difficult to interpret h alone (Bruce et al., 2016). h values were calculated for descriptive purposes only. Data from the hyperbolic and hyperboloid equations were used to answer a peripheral research question regarding model fit.

Pearson's r correlations between AUC values of the PDC, substance use, age, education, and levels of speech use were used to determine their inclusion as potential covariates (Boyle et al., 2018; MacKillop et al., 2011). Variables that significantly correlated with all three PDC conditions across the total sample were considered significant covariates as this would suggest a robust relation with discounting (Rodriguez et al., 2021). Independent samples t-tests and chi-square analyses were utilized to determine differences in demographic variables between the two groups (AWS vs. AWNS).

A 2 × 3 mixed design ANOVA was used to determine the main effects of group (AWS vs. AWNS as the between-subjects factor) and negative reaction (10%, 50%, and 90% as the within-subjects factor), and interactions on AUC values from the PDC. Pearson's r correlations were conducted to determine associations between the PDC, CPI, and other measures of stuttering and relevant treatment and demographic factors across the total sample, and with AWS and AWNS independently.

Systematic Versus Nonsystematic Responder Analysis. Although PD asserts that a systematic decrease occurs as odds increase, not all individuals demonstrate this expected pattern of responding (Johnson & Bickel, 2008; K. R. Smith et al., 2018); rather, they exhibit non-systematic responding. The occurrence of non-systematic responding, such as random responding by participants, can introduce variance that skews results and subsequent interpretation of discounting data, in addition to highlighting relevant characteristics of the participant pool (Craft et al., 2022). Therefore, to help researchers identify these types of responders, Johnson and Bickel (2008) developed a two-criterion algorithm that can be used to aid researchers in identifying non-systematic data. First, indifference points should decrease in a systematic manner across odds such that subsequent indifference points are no larger than 20% in magnitude of the previous indifference point. Second, the last indifference point should be 10% or less in magnitude than the first indifference point. Violation of either criteria would be classified as non-systematic.

Non-systematic data in discounting tasks may also indicate something meaningful about the data. Indeed, some individuals demonstrate limited sensitivity to changing risk and exclusively select either the smaller, for certain outcome or the larger, uncertain outcome resulting in a flat line as opposed to a hyperbolic curve; these patterns would indicate an especially risk averse or risky pattern of behavior, respectively. In addition, it has been shown that outcomes that do not function as a reinforcer for individuals also result in patterns with higher non-systematic responses (e.g., Lawyer, 2008; Lawyer et al., 2010).

The comparison of non-systematic and systematic responders may highlight different demographic factors that make individuals sensitive to specific discounting tasks relative to others. For example, AWS may show relatively more systematic responses in discounting tasks with communication as an outcome across differing fluency risks given their lifetime experiences with these variables. AWNS, however, may show relatively more non-systematic responding and less sensitivity to fluent communication as an outcome given their limited experience in navigating the occurrence of dysfluencies while communicating with other individuals. Chi-square analyses were used to determine if there were significant differences in percentage of systematic responders between AWS and AWNS.

Transparency and Openness. We described our sampling plan, manipulations, measures relevant to the current study, and adhered to the *Journal of Experimental Psychology: General* methodical checklist. The novel measure for the study is available in the Appendix and processed data for the study is available upon request from the corresponding author. The study design and hypotheses were not preregistered because data were collected as a part of a dissertation project.

Results

Demographic Information

One hundred percent of AWNS were recruited through MTurk. For AWS, 4% were recruited through MTurk or social media, whereas the remaining participants were recruited through the NSA listserv. Demographic information for AWS and AWNS is presented in Table 1. Specific stuttering and treatment characteristics of the AWS group are presented in Table 2. Individuals in the AWS group were significantly older, $t[104.31] = -4.04$, $p < .001$, 95%CI [−12.94, −4.42], $d = 0.67$, more likely to identify as male, $\chi^2[1] = 4.70$, $p = .03$, and to have obtained a degree in higher education relative to the AWNS group, $\chi^2[1] = 3.90$, $p = .05$. AWS group scored significantly lower on the measure of communication participation, that is, the CPI; $t[157.16] = 157.16$, $p < .001$, [5.23,11.24], $d = 0.84$, and significantly higher a stuttering severity measure, that is, SSS; $t[155] = -5.84$, $p < .001$, [−38.86, −19.22], $d = 0.95$, compared to the AWNS group. AWNS endorsed greater frequencies of smoking, $\chi^2[1] = 17.81$, $p < .001$, and use of e-nicotine delivery systems, $\chi^2[1] = 6.69$, $p = .01$, within the past year compared to AWS group, but neither group significantly differed on severity of tobacco use. There were no other differences on demographic, level of speech use, alcohol, or substance use measures.

Probability Discounting

Systematic Versus Non-Systematic Responding

The percentage of systematic and non-systematic responders across groups and the three levels of negative reaction probabilities (10%, 50%, and 90%) are presented in Figure 3. Indifference points across both groups were classified as systematic or non-systematic utilizing criteria described in Johnson and Bickel (2008). Between 49% and 90% of the data were systematic (i.e., showed the expected hyperbolic pattern), depending on NR condition. Importantly, there were differences in systematic data between the AWS and AWNS groups. AWS showed significantly higher systematic data (between 79% and 90%) than the AWNS group (between 49% and 63%). Moreover, there were group differences across the 10%, $\chi^2[1] = 17.81$, $p < .001$; 50%, $\chi^2[1] = 4.21$, $p = .04$; and 90% NR conditions, $\chi^2[1] = 14.51$, $p < .001$.

Odds ratios for systematic responding between groups varied across the three NR conditions. For the 10% NR condition, the odds of being a systematic responder were 5.91 times higher for the AWS group than those in the AWNS group (i.e., AWS were about 6× more likely to show hyperbolic discounting pattern than AWNS). For the 50% NR condition, the odds of being systematic were 2.09 times higher. For the 90% NR condition, the odds of being systematic were 3.87 times higher.

Discounting Curves

Discounting curves for each condition and group for both discounting models (dashed lines: hyperbolic; solid lines: hyperboloid) are presented in Figure 4. Across all NR conditions, both AWS (circles) and AWNS (squares) demonstrated a hyperbolic decay in communication likelihood as the odds of stuttering increased. Residual sum of squares (RSS) were used to describe the discounting model fit across total as opposed to R^2 as R^2 can sometimes result in uninterpretable negative values and is based on the assumption of a linear—not a nonlinear—relationship between variables (Johnson & Bickel, 2008; Lawyer & Schoepflin, 2013; Spiess & Neumeyer, 2010). Lower RSS scores indicate better fit. Figure 5

Table 1
Demographics Table of Total Sample

Variable	Total sample $N = 160$ M (SE)	AWS $n = 67$ M (SE)	AWNS $n = 93$ M (SE)	p
Age	38.24 (1.04)	43.28 (1.89)	34.60 (1.03)	<.001*
Gender				.03*
Female	51.9%	41.8%	59.1%	
Male	48.1%	58.2%	40.9%	
% White[a]	75.6%	77.6%	74.2%	.62
Income	$61,581.26 (5,666.85)	$61,328.22 (5,857.23)	$61,765.53 (8,845.39)	.97
% Higher education degree	67.5%	76.1%	61.3%	.05*
% Employed for wages	81.3%	77.6%	83.9%	.32
CPI T-scores	54.19 (0.86)	49.40 (0.94)	57.64 (1.20)	<.001*
SSS total	41.90 (2.70)	58.04 (3.79)	30.02 (3.27)	<.001*
LSURS				.87
Undemanding	7.5%	7.5%	7.5%	
Intermittent	36.3%	38.8%	34.4%	
Routine	33.8%	34.3%	33.3%	
Extensive	18.8%	14.9%	21.5%	
Extraordinary	3.8%	4.5%	3.2%	
% used alcohol in the past year	75%	73.1%	76.3%	.64
% used illicit substances in the past year	24.4%	19.4%	28.0%	.23
% used cigarettes in the past year	26.3%	9%	38.7%	<.001*
% used e-cigarettes in the past year	16.3%	7.5%	22.8%	.01*
Endorsed mental health diagnosis	30%	31.3%	29%	.75

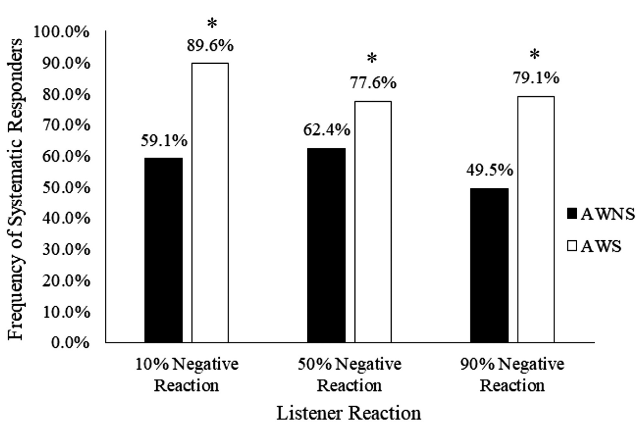
Note. AWS = adults who stutter; AWNS = adults who do not stutter; CPI = communicative participation item bank; SSS = subjective stuttering scales; LSURS = level of speech use rating scale.
[a] Largest group by percentage.
*$p \le .05$.

Table 2
Stuttering and Treatment Characteristics of AWS

Variable	*M* (*SE*)
Age of stuttering onset	4.63 (0.22)
Years stuttering diagnosing provider	38.66 (1.91)
Speech-language pathologist	88.1%
Medical provider	1.5%
Psychologist	4.5%
Other	1.5%
OASES-A Total Scores	3.35 (0.09)
OASES-A Specifiers	
Mild/moderate	9.0%
Moderate	19.4%
Moderate/severe	34.3%
Severe	37.3%
Currently experiencing stuttering	94%
Number of treatment attempts	2.64 (0.16)
Previously attended treatment for stuttering	92.6%
Past stuttering treatment provider	
Speech-language pathologist	90%
Medical provider	2.0%
Psychologist	4.0%
Other	4.0%
Noticed improvement in dysfluencies from past stuttering treatment	64%
Satisfaction with past treatment	3.36 (0.17)
Currently attending treatment for stuttering	14.9%
Current stuttering treatment provider	
Speech-language pathologist	100%
Medical provider	0%
Psychologist	0%
Other	0%
Noticed improvement in dysfluencies from current treatment	11.9%
Satisfaction with current treatment	4.3 (0.21)
Currently have prescription for stutter	4.5%

Note. AWS = adults who stutter; OASES-A = overall assessment of the speaker's experience of stuttering—adult; satisfaction for stuttering treatment rated on a 5-point Likert scale (1 = very unsatisfied to 5 = very satisfied).

Figure 3
Frequencies of Systematic Responders



Note. AWNS = adults who do not stutter; AWS = adults who do stutter. *$p < .05$.

displays mean RSS as a function of stuttering status and discounting model. Analysis revealed a main effect of model type with hyperboloid showing a significantly better fit across the 10% NR, $F[1,154] = 60.301$, $p < .001$, $\eta_p^2 = 0.28$; 50% NR, $F[1,149] = 11.25$, $p = .001$, $\eta_p^2 = 0.07$; and the 90% NR, $F[1,143] = 45.37$, $p < .001$, $\eta_p^2 = 0.24$). In the 90% NR condition, there was a main effect of group, $F[1,143] = 4.04$, $p = .04$, $\eta_p^2 = 0.03$, with AWS showing lower RSS than AWNS. No significant model × group interactions were observed across any NR condition.

Mean AUC values that reflect discounting are presented in Figure 6 as a function of NR condition. None of the proposed covariates significantly correlated with the PDC, therefore they were not included in the main analysis. A mixed ANOVA revealed a significant main effect of magnitude on AUC values, $F[2,316] = 103.15$, $p < .001$, $\eta_p^2 = 0.40$. Simple contrast analyses revealed that the 50% NR condition, $F[1,158] = 101.08$, $p < .001$, $\eta_p^2 = 0.39$ and the 90% NR condition, $F[1,158] = 130.06$, $p < .001$, $\eta_p^2 = 0.45$, were significantly lower than the 10% NR condition when controlling for the main effect of group. There was no significant main effect of group. There was, however, a significant interaction of magnitude × group, $F[2,316] = 3.45$, $p = .03$, $\eta_p^2 = .02$. The interaction was primarily driven by the significantly lower AUC scores in the AWS group ($M = 0.37$, $SE = 0.04$) compared to the AWNS group ($M = 0.42$, $SE = 0.03$) in the 90% negative reaction condition. Analyses with systematic responders only continued to show the main effect of magnitude; however, neither the main effect of group nor the interaction were significant.

AWS Only

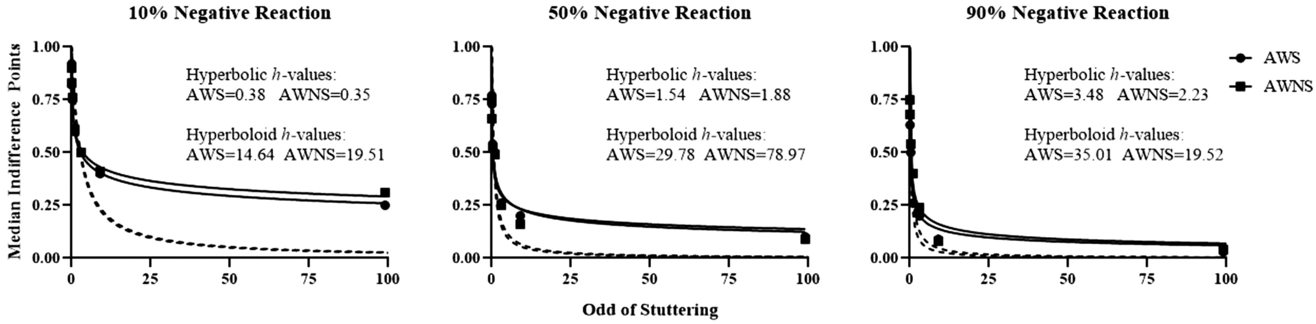
To determine if relations among stuttering and communication measures and the PDC were dependent upon AWS or AWNS status, correlations were conducted separately for each group. Correlations between the PDC and other measures among the AWS group only are presented in Table 3. Pearson's r correlations revealed that AUC values were significantly correlated with one another across the three NR conditions ($r = .72$–$.89$, $p < .01$). The CPI also showed positive correlations with AUC values across NR condition ($r = .45$–$.52$, $p < .01$). Measures of stuttering—the OASES-A ($r = -.42$ to $-.54$, $p < .01$) and SSS ($r = -.28$ to $-.47$, $p < .05$)—were negatively correlated with AUC values across all three NR conditions. When all analyses were conducted with only systematic responders, all significant relations remained similar with two exceptions: the SSS's association with AUC values in the 10% NR condition and speech use (LSUR) and AUC was only significant with the 90% NR condition.

AWNS Only

Correlations between the PDC and other measures in the AWNS group are presented in Table 4. The CPI and 10% NR AUC value showed a significant, positive relation ($r = .23$, $p = .03$). No other significant associations were observed across the 50% and 90% NR conditions. The SSS showed a significant, positive association with 90% NR AUC values ($r = .27$, $p = .01$), but no other significant associations were observed across other NR conditions. When examining systematic responders only, correlations between the PDC, CPI, and SSS were no longer significant among AWNS.

Figure 4

Goodness-of-Fit Lines and Discounting Values of Median Indifference Points



Note. AWS = adults who stutter; AWNS = adults who do not stutter; subjective value (median indifference points) of communicating as a function of the odds of stuttering across three different probabilities of a negative reaction. The goodness of fit lines using the hyperbolic function (Equations 1) are represented with dashed lines and the hyperboloid function (Equations 2) is represented with solid lines.

Discussion

The purpose of the present study was to develop a PD task for communication and to validate it by comparing the frequency of systematic responding and communication discounting across AWS and AWNS. To further validate it, associations between the PDC and other measures of communication were examined between groups.

Hypothesis 1: AWS Would Demonstrate Orderly (Hyperbolic Fit) and Steeper Discounting Patterns for Communication Compared to AWNS

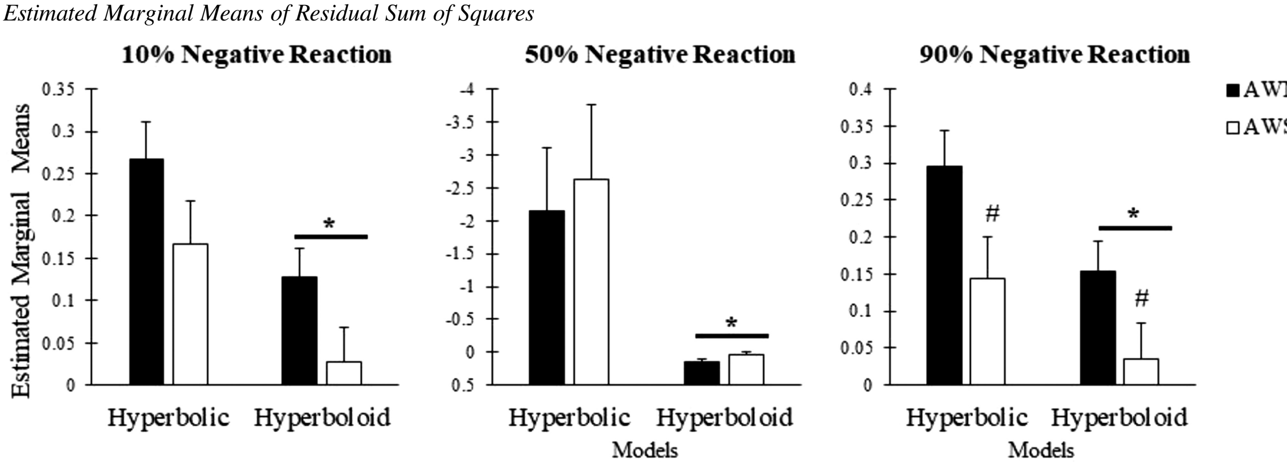
Our initial hypothesis showed partial support. AWS demonstrated significantly lower AUC values (i.e., steeper discounting) compared to AWNS under conditions of highest risk of NR from the listener. However, the effect of the interaction was small, only accounting for 2% of the variance, and was not significant when examined with systematic responders only. Moreover, there was no group difference with the other NR conditions. This lack of a robust between-group discounting finding was unexpected, given the greater history of negative communicative experiences among AWS (Boyle, 2017; Bricker-Katz et al., 2010, 2013; Klein & Hood, 2004; Logan & O'Connor, 2012; Zeigler-Hill et al., 2020).

There are potential reasons for this lack of difference. First, it may be that the negative communication experiences associated specifically with stuttering may not be associated with differences in communication on the PDC. In other words, an individual's sensitivity to risk taking may not be associated with one's communication decision-making processes. Second, recruitment practices differed between the two groups. All but three AWS were recruited through the NSA listserv, a non-profit organization focused on fostering an affirming environment for individuals who stutter (National Stuttering Association, 2020). It may be possible that among this sample, exposure to NSA-contingencies focused on the reinforcement of community-building behaviors and communication *as opposed to decreasing dysfluencies* attenuated the participants' sensitivity to aversive variables (e.g., J. M. Cohen et al., 2021; Ellis et al., 2020).

Although AUC values did not consistently produce meaningful group differences, examination of systematic data between AWS

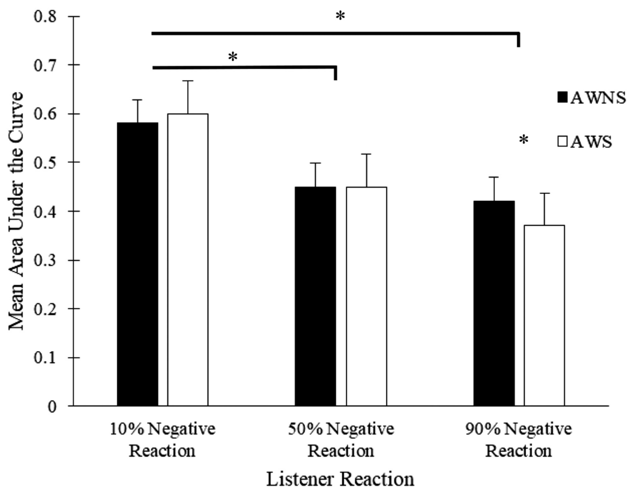
Figure 5

Estimated Marginal Means of Residual Sum of Squares



Note. AWNS = adults who do not stutter; AWS = adults who stutter. Error bars represent 1 SEM.
*$p < .05$.

Figure 6
Area Under the Curve Values Between AWS and AWNS Groups



Note. AWNS = adults who do not stutter; AWS = adults who stutter.
$^*p < .05$.

versus AWNS produces a potentially meaningful effect. Between 77.6% and 89.6% (depending on NR condition) were systematic for those who stutter, while only 49.5%–62.4% were systematic for those who do not stutter. This means that AWS has between 2.09 and 5.91 greater odds of producing systematic PD data than AWNS. The frequency of systematic responders in the AWS group of the current study was comparable to percentages found in other discounting studies using monetary or non-monetary outcomes (e.g., Hendrickson et al., 2015; Rasmussen et al., 2010; K. R. Smith et al., 2018; Weatherly, 2014). These results may suggest that AWS, relative to AWNS, demonstrates a relatively stronger sensitivity to the communication outcome of the discounting task, which may be due to differences in learning history or valuing of a particular outcome (Lawyer, 2008; K. R. Smith et al., 2018). For instance, individuals who stutter are more likely to receive feedback from others about their communication compared to those who do not stutter (Boyle, 2017; Bricker-Katz et al., 2010; Plexico et al., 2009; Zeigler-Hill et al., 2020). Therefore, the percent of systematic data one produces on the PDC may be a more sensitive measure of the consequences of stuttering, as opposed to the discounting values themselves.

Magnitude Effect

When examining differences in AUC, steeper discounting was observed as the NR condition increased, regardless of group, suggesting a magnitude effect. In other words, communication discounting was steeper with higher probability of negative social feedback. Magnitude effects have been previously demonstrated across other commodities such as money (Myerson et al., 2011), illicit substances (Kirby et al., 1999), and food (Hendrickson et al., 2015). This novel finding from this study, then, expands the literature on magnitude effects of discounting to include communication as an outcome.

Model Comparison

The subjective value of communication was appropriately modeled by probability discounting by demonstrating a hyperbolic decrease as the odds of stuttering increased. Both the hyperbolic and hyperboloid models showed adequate fit to participants' indifference points. The hyperboloid model, however, showed a significantly better fit across both groups suggesting that communication discounting may follow a hyperbola-type pattern regardless of an individual's stuttering status. While the inclusion of an additional parameter is likely to increase model fit, adding the scaling parameter (s) accounted for significantly more variance. This suggests that an individual's over- or underestimation of differences between odds (as indicated by the s factor) may play an equally important role in communication choice behavior beyond sensitivity to just simply increasing the risk (Bruce et al., 2016; Bruce, Jarmolowicz, et al., 2018; Green et al., 1994). In other words, one's perception of *the change between risk values* determines how much subjective value decreases or levels off. This should be explored in future research.

Hypotheses 2 and 3: Negative Associations Between PDC and Communication Measures and Positive Associations Between PDC and Stuttering Severity Measures

In AWS, higher discounting (i.e., lower AUC values) was significantly and consistently associated with lower communication and speech use; this was not observed in AWNS. Additionally, higher stuttering severity scores among AWS were associated with higher discounting. The association between discounting and stuttering

Table 3
Pearson's r *Correlations Among AWS Only* (n = 67)

Variable	1	2	3	4	5	6	7	8
1. AUC 10% NR	—							
2. AUC 50% NR	.82**	—						
3. AUC 90% NR	.72**	.89**	—					
4. CPI T-score	.45**	.52**	.54**	—				
5. OASES-A total	−.42**	−.51**	−.54**	−.84**	—			
6. SSS total	−.28*	−.41**	−.47**	−.73**	−.80**	—		
7. LSURS	.30*	.34**	.33**	.36**	−.39**	−.25*	—	
8. # of years stuttering	−.06	.08	.10	.16	−.18	−.18	−.04	—
9. # of tx attempts	.09	.07	.08	−.04	.09	−.02	−.15	.03

Note. NR = negative reaction; AUC = area under the curve; CPI = communicative participation item bank; OASES-A = overall assessment of the speaker's experience of stuttering-adult; SSS = subjective stuttering scales; LSURS = level of speech use rating scale; tx = treatment.
$^*p \leq .05$. $^{**}p < .01$.

Table 4
Pearson's r *Correlations Among AWNS* (n = *93)*

Variable	1	2	3	4	5
1. AUC 10% NR	—				
2. AUC 50% NR	.75**	—			
3. AUC 90% NR	.66**	.89**	—		
4. CPI T-score	.23*	.07	−.03	—	
5. SSS total	−.02	.17	.27*	−.68**	—
6. LSURS	.09	.02	−.07	.33**	−.29**

Note. NR = negative reaction; AUC = area under the curve; CPI = communicative participation item bank; SSS = subjective stuttering scales; LSURS = level of speech use rating scale.
*$p < .05$. **$p < .01$.

severity increased in strength as the risk of negative social response increased. The results were consistent with our hypotheses.

Although causality cannot be ascertained currently, these associations suggest an interaction between stuttering, risk taking, and communication. One such interaction might include the following: Increased stuttering symptoms may increase one's likelihood of being subjected to negative social feedback. Repeated exposure to this persistent invalidation could lead to increased sensitivity to variables that heighten the risk of a stutter to occur which can alter an individual's valuation of communication. In turn, the devaluation (i.e., discounting) of communication as an outcome can in turn lead to a reduction in speech usage and communicative engagement. The decrease in communication can lead to further negative social experiences and the cycle repeats itself. While the causal nature of these relations is speculative, there is indeed some support for this conceptualization as marginalized individuals' experiences with invalidation and discrimination can heighten one's sensitivity to rejection and internal affective states (J. M. Cohen et al., 2016; Pachankis, 2007; Testa et al., 2015). Indeed, AWS has been shown to become hypervigilant to negative social cues and information following evaluative social interaction information (Bauerly, 2022; Lowe et al., 2016). More research on how these variables are related is needed.

Limitations and Future Directions

A limitation of the current study is the lack of a clinician-administered stuttering measure that includes a performance-based task (e.g., SSI-4; G. D. Riley, 2009). The inclusion of this type of task would provide additional information on the frequency and severity of dysfluencies as well as confirmation of the stuttering diagnosis within the sample. While prior research has utilized self-report methods to characterize dysfluency (Boyle et al., 2018), one's perception of their dysfluencies and to task performance may notably differ. It is possible that task performance (e.g., percent of syllables stuttered) may have an association with communication discounting. In addition, the demonstrating an association between additional measures of stuttering can help to increase the validity of the PDC. The inclusion of a performance task and its association with communication discounting is an area that warrants further research.

Another limitation of the current study is the absence of a previously established PD measure for comparison. Prior research on the development of new discounting measures typically includes a previously established discounting measure with either a similar or differing commodity (e.g., food vs. money; Hendrickson et al., 2015; Rodriguez et al., 2018) to allow comparison of data. We did not include this in the current study because the main focus was to determine if communication could be discounted. Future research would benefit from the inclusion of an additional discounting task with a different commodity.

Relative to the AWS group, AWNS were asked to imagine the experience of stuttering with only basic written instructions and no model. Prior discounting research has utilized outcomes in which most if not all the sample is somewhat familiar (e.g., food or money). A limited understanding of stuttering or its experience may have influenced how the AWNS interpreted each item of the PDC. Their perceptions and understanding of stuttering may function as a potential covariate that could not only influence their rate of discounting but also lead to changes in the frequency of systematic versus nonsystematic responding. This is an area that warrants future research and may include the use of video clips or other ways to model a moment of stuttering.

The lack of diverse sources of recruitment for AWS may be another limitation as the affirming environment of the NSA could have decreased one's sensitivity to stuttering odds. Future research could benefit from recruiting AWS who have limited or no exposure to the NSA. It is possible that exposure to stuttering-affirmative environments may moderate the effects of communication discounting and its inclusion may reveal potential differences among subgroups of AWS and when compared to AWNS. Similarly, the use of MTurk to recruit AWNS may have contributed to the greater non-systematic response due to potential for poorer data quality using this method (Chmielewski & Kucker, 2020; Craft et al., 2022). Future researchers who wish to use online crowd sourcing for participant recruitment may benefit from using additional recruiting pools, more rigorous screening methods, and embedded validity indicators (Chmielewski & Kucker, 2020).

While this study examined the extent to which the hyperbolic and hyperboloid functions fit communication discounting data, other models of discounting (i.e., exponential model) were not examined (Rachlin et al., 1991). Previous research has suggested that across both human and non-human subjects, hyperbolic- and hyperboloid models better fit the data (McKerchar et al., 2009; Vanderveldt et al., 2016). However, given the novelty of communication as an outcome in the discounting literature, comparison of alternative discounting models could be an area of future research.

Due to a number of variables being correlated, it is possible that some of the associations could be a result of a Type I error. Future research should be conducted with similar variables and measures to assess the stability of these correlations.

Implications

Steep communication discounting could indicate treatment nonadherence, motivation, and relapse (Bruce, Bruce, et al., 2018; Jarmolowicz et al., 2017; Yoon et al., 2007), and may even serve as a potential indicator of where to focus treatment goals among AWS (Jarmolowicz et al., 2017). For instance, an individual who demonstrates higher sensitivity to dysfluency risk, but less sensitivity to negative social reactions may indicate that the individual is more sensitive to their stutter relative to other aspects of speaking risk. Treatment goals could focus on psychoeducation and awareness-building techniques (e.g., mindfulness, tallying, mirror work, video/audio recordings, etc.) or the development of positive self-identity as a person who stutters (Guitar, 2014; Plexico et al., 2019). On the other hand, if an individual is more sensitive to the interpersonal aspects of speech (i.e., negative reactions), treatment goals may focus more on assertive communication skills, use of disclosure statements, forming relationships, community building, family therapy, or decreasing social anxiety, for example. Notably, these types of treatment goals would warrant an interdisciplinary approach between both speech-language pathology and mental health professionals to provide a more holistic approach to stuttering treatment (Yates et al., 2018). Integrating the PDC as part of a pre-post-treatment assessment battery would be a way to examine if changes in these areas of functioning for AWS are associated with changes in probability discounting and would pave the way for establishing potential norms and clinical cut-offs.

Overall, the current findings uniquely show that communication value can be discounted; that is, the subjective value of communication decreases hyperbolically as odds for dysfluency and negative social outcome increase. Notably, the PDC shows some validity in its use among a stuttering population given its association with stuttering measures in a stuttering population and not in a non-stuttering population. Further, AWS demonstrated more systematic responding —suggesting increased sensitivity to communication outcomes— when compared to their non-stuttering counterparts, which is likely due to lived experiences with stuttering. Therefore, the PDC appears to be an internally and externally valid measure of communication PD for AWS and has clinical utility for this population.

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(*Appendices follow*)

Appendix

PDC

The following questions will refer to the most severe moment of stuttering you have ever experienced in your lifetime. Please answer the following questions as accurately as you can.

Where were you when it occurred? ____

How old were you when it occurred? ____________________

In minutes, how long did the severe stuttering event last? ______________(e.g., 10 minutes)

Please check the following overt stuttering behavior(s) that occurred during the most severe event.

() Repetitions (e.g., I-I-I-I-I; k-k-k-k-k)

() Prolongation (e.g., aaaaaaaaapple)

() Blocks (e.g., b_ _ _lock)

Not counting yourself, how many other people were present? ______________________________

Please indicate the relationship of the individual(s) present to you (e.g., spouse, partner, family member, friend, stranger, co-worker, etc.)

____-
____

Use the following scale to answer the following question.

1 = Unsupportive (e.g., laughing, mocking, appeared frustrated, talking over me, etc.) to 5 = Supportive (e.g., appeared patient, waited for me to speak, maintained appropriate eye contact, etc.)

In general, how you would rate the reaction(s) of the individual(s) present? 1 2 3 4 5

For the following questions, you will be asked to imagine yourself in different speaking scenarios between you and one other person. During each conversation, you may or may not experience the severe moment of stuttering you previously described. The moment of stuttering may include repetitions (e.g., I-I-I-I-I; k-k-k-k-k), prolongations (e.g., aaaapple), and/or blocks (e.g., b_ _ _ _lock). Even if you attempt to modify or prevent the stutter during the conversation, it will still occur. In addition, the person you are conversing with may or may not have a negative reaction (e.g., laugh/make fun, cut you off, look uncomfortable or frustrated, etc.). After each scenario, you will be asked to rate the likelihood you would participate in the conversation on a scale of 0 = I definitely will **NOT** participate in the conversation to 100 = I definitely will participate in the conversation.

Imagine that you are about to engage in a conversation with another person with each of you expected to contribute approximately equally to the conversation. During the interaction, there is a **0% chance you will experience a severe moment of stuttering**. In addition, there is a **0% chance the person will respond negatively** (e.g., laugh/make fun, cut you off, look uncomfortable or frustrated, etc.).

0% 25% 50% 75% 100%
I definitely will **NOT** participate in the conversation — I definitely will participate in the conversation

Imagine that you are about to engage in a conversation with another person with each of you expected to contribute approximately equally to the conversation. During the interaction, there is a **1% chance you will experience a severe moment of stuttering**. In addition, there is a **10% chance the person will respond negatively** (e.g., laugh/make fun, cut you off, look uncomfortable or frustrated, etc.).

0% 25% 50% 75% 100%
I definitely will **NOT** participate in the conversation — I definitely will participate in the conversation

Imagine that you are about to engage in a conversation with another person with each of you expected to contribute approximately equally to the conversation. During the interaction, there is a **10% chance you will experience a severe moment of stuttering**. In addition, there is a **10% chance the person will respond negatively** (e.g., laugh/make fun, cut you off, look uncomfortable or frustrated, etc.).

0% 25% 50% 75% 100%
I definitely will **NOT** participate in the conversation — I definitely will participate in the conversation

Imagine that you are about to engage in a conversation with another person with each of you expected to contribute approximately equally to the conversation. During the interaction, there is a **25% chance you will experience a severe moment of stuttering**. In addition, there is a **10% chance the person will respond negatively** (e.g., laugh/make fun, cut you off, look uncomfortable or frustrated, etc.).

0% 25% 50% 75% 100%
I definitely will **NOT** participate in the conversation — I definitely will participate in the conversation

Imagine that you are about to engage in a conversation with another person with each of you expected to contribute approximately equally to the conversation. During the interaction, there is a **50% chance you will experience a severe moment of stuttering**. In addition, there is a **10% chance the person will respond negatively** (e.g., laugh/make fun, cut you off, look uncomfortable or frustrated, etc.).

0% 25% 50% 75% 100%
I definitely will **NOT** participate in the conversation — I definitely will participate in the conversation

(*Appendices continue*)

Imagine that you are about to engage in a conversation with another person with each of you expected to contribute approximately equally to the conversation. During the interaction, there is a **75% chance you will experience a severe moment of stuttering**. In addition, there is a **10% chance the person will respond negatively** (e.g., laugh/make fun, cut you off, look uncomfortable or frustrated, etc.).

0% 25% 50% 75% 100%

I definitely will **NOT** participate in the conversation — I definitely will participate in the conversation

Imagine that you are about to engage in a conversation with another person with each of you expected to contribute approximately equally to the conversation. During the interaction, there is a **90% chance you will experience a severe moment of stuttering**. In addition, there is a **10% chance the person will respond negatively** (e.g., laugh/make fun, cut you off, look uncomfortable or frustrated, etc.).

0% 25% 50% 75% 100%

I definitely will **NOT** participate in the conversation — I definitely will participate in the conversation

Imagine that you are about to engage in a conversation with another person with each of you expected to contribute approximately equally to the conversation. During the interaction, there is a **99% chance you will experience a severe moment of stuttering**. In addition, there is a **10% chance the person will respond negatively** (e.g., laugh/make fun, cut you off, look uncomfortable or frustrated, etc.).

0% 25% 50% 75% 100%

I definitely will **NOT** participate in the conversation — I definitely will participate in the conversation

Imagine that you are about to engage in a conversation with another person with each of you expected to contribute approximately equally to the conversation. During the interaction, there is a **1% chance you will experience a severe moment of stuttering**. In addition, there is a **50% chance the person will respond negatively** (e.g., laugh/make fun, cut you off, look uncomfortable or frustrated, etc.).

0% 25% 50% 75% 100%

I definitely will **NOT** participate in the conversation — I definitely will participate in the conversation

Imagine that you are about to engage in a conversation with another person with each of you expected to contribute approximately equally to the conversation. During the interaction, there is a **10% chance you will experience a severe moment of stuttering**. In addition, there is a **50% chance the person will respond negatively** (e.g., laugh/make fun, cut you off, look uncomfortable or frustrated, etc.).

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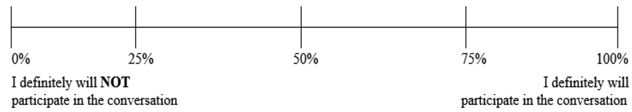

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